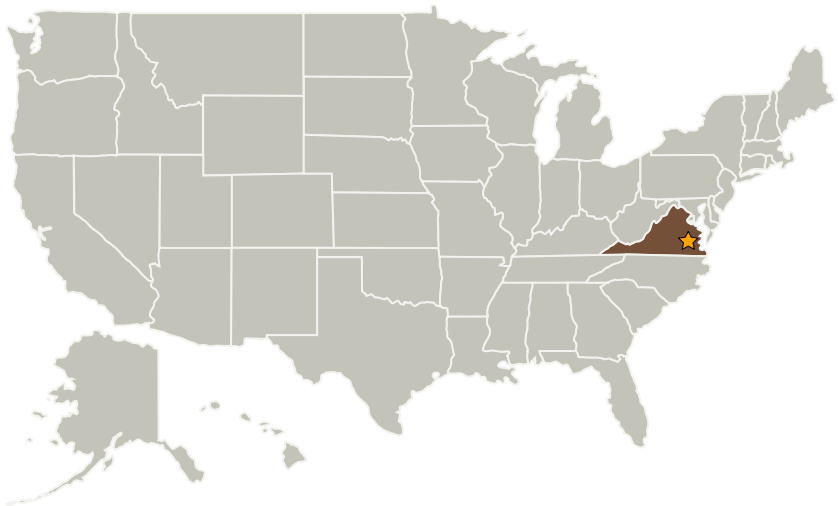
Real-Time Adaptive Algorithms for Flight Control Diagnostics and Prognostics, Phase II

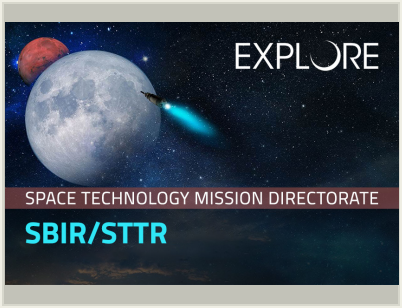
Completed Technology Project (2007 - 2009)

Project Introduction

The overall objective of this research program is to improve the affordability, survivability, and service life of next generation aircraft through the use of ADAPT --- an integrated adaptive diagnostic and prognostic toolbox. The specific focus of the research effort is adaptive diagnostic and prognostic algorithms for systems with slowly-varying dynamics. Model-based machinery diagnostic and prognostic techniques depend upon high-quality mathematical models of the plant. Modeling uncertainties and errors decrease system sensitivity to faults and decrease the accuracy of failure prognoses. However, the behavior of many physical systems changes slowly over time as the system ages. These changes may be perfectly normal and not indicative of impending failures; however, if a static model is used, modeling errors may increase over time, which can adversely affect health monitoring system performance. Clearly, one method to address this problem is to employ a model that adapts to system changes over time. The risk in using data-driven models that learn online to support model-based diagnostics is that the models may "adapt" to a system failure, thus rendering it undetectable by the diagnostic algorithms. An inherent trade-off exists between accurately tracking normal variations in system dynamics and potentially obscuring slow-onset failures by adapting to failure precursors that would be evident using static models. The proposed ADAPT will feature an innovative new parameter estimation algorithm and new adaptive observer / Kalman filter techniques designed specifically for health monitoring. The research team of Barron Associates, Inc., the University of Virginia, and Lockheed Martin Aeronautics Company will demonstrate ADAPT using a high-fidelity electro-hydrostatic actuator simulation.

Primary U.S. Work Locations and Key Partners





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Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Center / Facility:

Langley Research Center (LaRC)

Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

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Organizations Performing Work	Role	Type	Location
★Langley Research Center(LaRC)	Lead Organization	NASA Center	Hampton, Virginia
Barron Associates, Inc.	Supporting Organization	Industry	Charlottesville, Virginia

Primary U.S. Work Locations
Virginia

Project Transitions

November 2007: Project Start

November 2009: Closed out

Project Management

Program Director:

Jason L Kessler

Program Manager:

Carlos Torrez

Technology Areas

Primary:

- TX10 Autonomous Systems
  - TX10.2 Reasoning and Acting
    - TX10.2.7 Learning and Adapting